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COPPER
Its Effect Upon
STEEL
for
Roofing Terne Plates



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COPPER

Its Effect Upon

STEEL

for

Roofing Terne Plates



— Manufactured by —

AMERICAN SHEET AND TIN PLATE COMPANY

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

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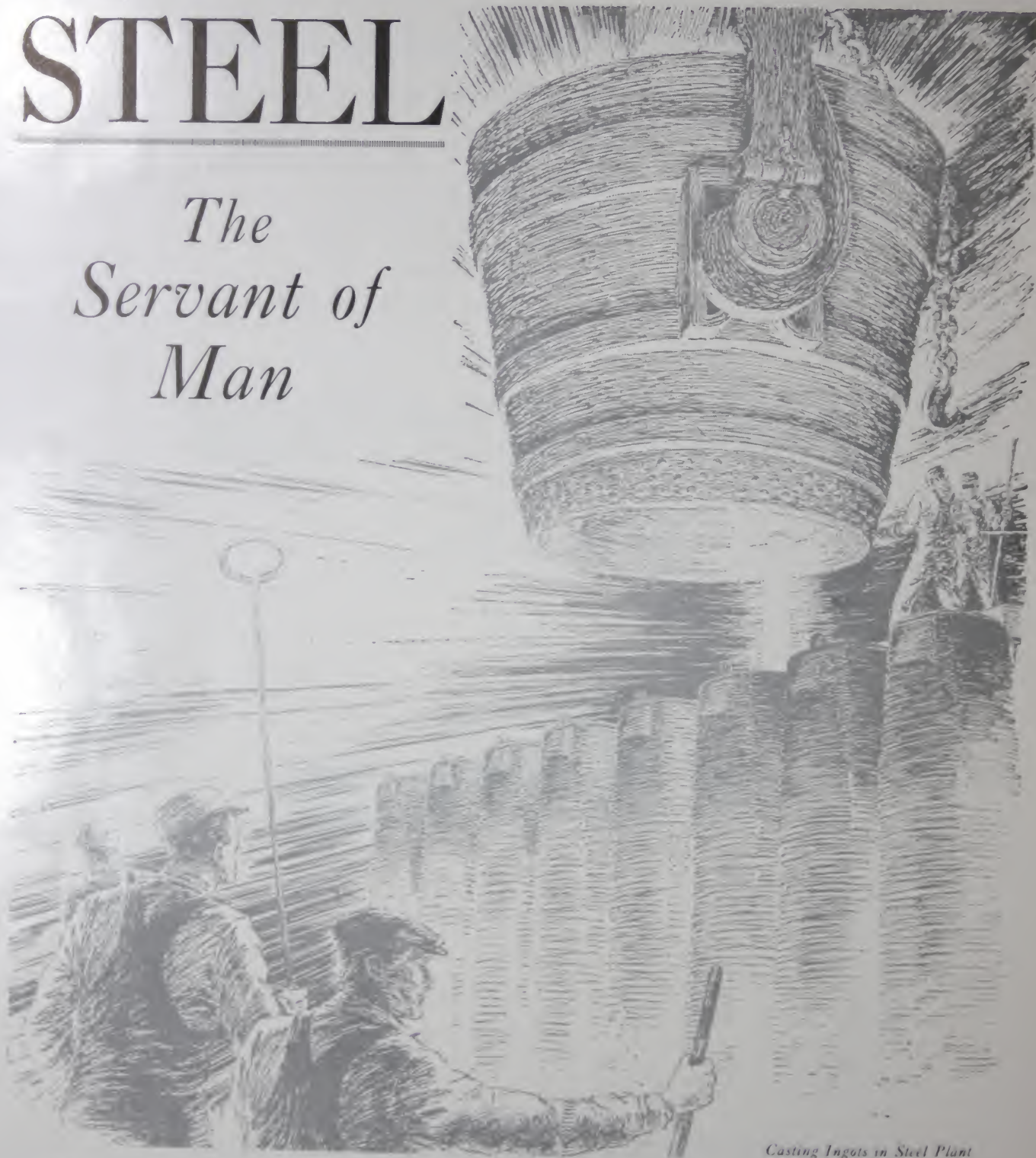
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(Printed in U. S. A.)

STEEL

*The
Servant of
Man*



Casting Ingots in Steel Plant

Meeting today's diverse demands for sheet steel products requires the making of numerous grades in varying degrees of finish, and other distinctive qualities.

AMERICAN Sheets and Tin and Terne Plates are adapted to all uses to which sheet metal is applicable. KEYSTONE Quality gives maximum rust-resistance.

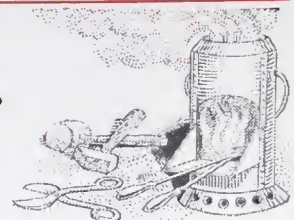
Look for This Stamp—



It Protects the User



The Roof of *Quality* and *Service*
is made from



KEYSTONE COPPER STEEL ROOFING TERNES

K EYSTONE Copper Steel is an alloy made by the addition of a certain percentage of copper to well made steel, thereby greatly increasing its lasting or rust-resisting qualities under actual service conditions. This material is particularly adapted to the manufacture of Roofing Terne Plate and various sheet metal products.

Terne Plate or "Roofing Tin" was subjected to criticism and disfavor as a roofing product, a number of years ago, primarily through the action of certain manufacturers and dealers, who, in their anxiety to meet competition, not only furnished material of an inferior quality, but misrepresented the amount of coating on various brands. These tactics, coupled with poor workmanship on the part of some tinner, naturally caused builders to look for other materials for roofing purposes, and the many cheap substitutes introduced from time to time have practically all been proved to be entirely unfit for permanent roofing. This resulted in the action of the American Sheet and Tin Plate Company, who, in order to protect the ultimate consumer, inaugurated the policy in 1906 of stamping all of its Roofing Ternes with the weight of coating.

This Company also began experimenting with a view of supplying metal roofing superior to any which had been furnished in the past without materially increasing the cost. These experiments proved successful and announcement was made early in 1912 of the development of a product which would not only resist

the acid test upon which much stress was then being laid, but which would also resist corrosion in actual service better than any iron or steel product on the market. This material is known as *Keystone Copper Steel* and is furnished in either Black Sheets, Galvanized Sheets, Terne Plate or Tin Plate.

The conclusions were based upon actual tests with *uncoated* sheets upon roofs in several parts of the country. One of these was located in the Pennsylvania coke regions, where the air contains notable amounts of sulphurous and sulphuric acid and other fumes from the coke ovens. In this district, iron and steel, unless protected, corrode very fast. Another station was located on the sea coast, where the air carries sodium chloride. The third station was located in a rural district where the air is quite pure and free from added corrosive agents. At each of these stations a skeleton wooden building was erected, 40x80 feet, with a sloping roof at an angle of about 18 degrees with the low side about 6 feet from the ground. The buildings were entirely open and free to the passage of air on all four sides, and the roofs were uncovered

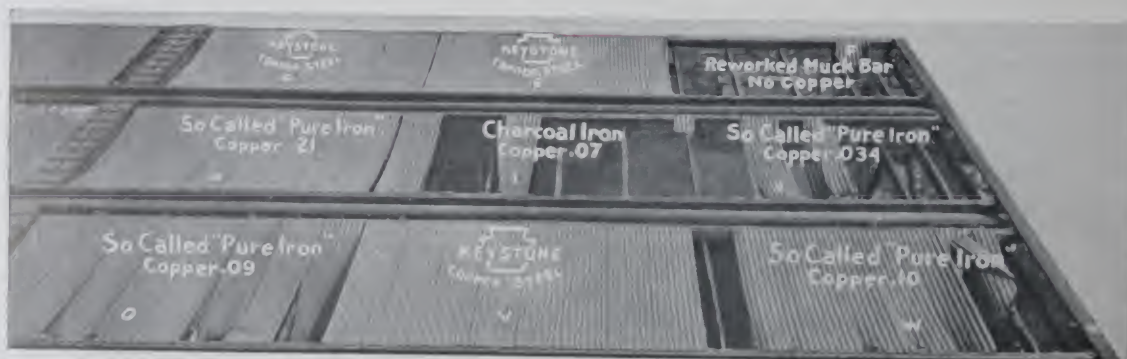
This Stamp— on Every Plate

until the sheets were put on. The sheets were arranged in panels, the grades being separated from each other by an open space. Open spaces were also left between each *course* so that the drip from one row did not run onto the row below.

As previously stated, all of the sheets were entirely unprotected by paint or other coating, which allowed natural corrosion to start immediately and to proceed without interruption. In conducting these tests, both regular Bessemer and Open Hearth Steel, with and without copper, were used; also sheets of the so-called "pure irons" which were pur-

ing from .15 to .25 per cent copper will resist corrosion from two to three times or more as well as the same steel without copper, and that it is also superior to the so-called "irons"—even though the latter contain a perceptible amount of copper. These results can perhaps best be appreciated by a glance at the illustrations of such tests.

Later tests of the same heats of steel containing various increments of copper established that the addition of .15 per cent minimum copper produces an alloy which offers practically maximum resistance to atmospheric corrosion.



This picture of the out-in-the-weather test roof, covered with uncoated black sheets, tells the whole story. The superiority of Keystone Copper Steel is clearly evidenced. The same advantage shown in other test roofs.

chased in the open market, and which, by the way, *analyzed about .07 copper*.

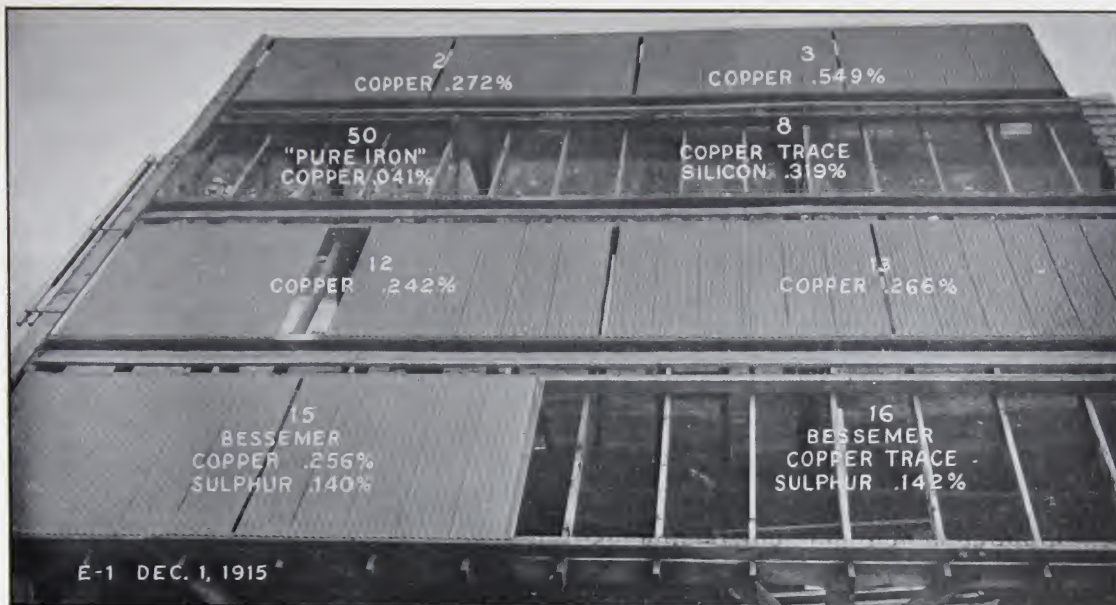
In order to avoid the possible uncertainty in comparing different heats of steel with and without copper and in order that the conditions, except the copper content, should be identical, it was decided for these comparisons to copperize portions of heats, leaving other portions of the same heat in their original condition. It will thus be seen that the tests were conducted fairly and that every element of doubt in so far as this was possible, was eliminated.

The results obtained from these investigations verified previous experiments along the same line, and proved conclusively that properly made steel contain-

The question has been asked as to whether or not the presence of copper in steel would set up galvanic action. This would happen, no doubt, if copper came in mechanical contact with steel, but it is *most decidedly untrue* when the two metals form an alloy, as in the case of Keystone Copper Steel. In other words, the two metals are not present as copper and steel, but in the form of a perfect alloy.

After establishing the foregoing facts, the American Sheet and Tin Plate Company decided to use Keystone Copper Steel exclusively in the manufacture of its Terne Plate for roofing purposes.

It is of interest to note that following the former extensive and thorough ser-



Results of Service Test
at Scottsdale, Pa.,
after about 1½ year's
exposure.

Roof covered with
uncoated black
sheets.

Note the superior rust-
resistance of Copper
Steel, containing the
proper percentage
of copper.

Arguments are
superfluous with
results like these.



This Stamp— *on Every Plate*

vice tests of this Company, the late D. M. Buck, Metallurgical Engineer for the Company, and J. O. Handy, Director of the Pittsburgh Testing Laboratories, made still further investigations and tests of a very comprehensive character, embracing the various grades of iron and steel on the market as ordinarily used for roofing purposes. The results of these additional tests and scientific investigations are overwhelmingly in favor of copper steel for roofing purposes, and for all other uses requiring the highest degree of resistance to corrosion resulting from exposure to the action of the elements.

In addition to the very careful and conclusive service tests noted above, the American Society for Testing Materials conducted a number of tests to prove the actual rust-resistance of various steel and iron sheets. After years of testing and proving under widely varying conditions of climate and atmosphere, the Society makes the following statement in their Proceedings, Vol. 21, 1921:

"Copper Bearing metal shows marked superiority in rust-resisting properties as compared to non-copper-bearing metal of substantially the same general composition, from which superiority we may truly anticipate a marked increase in the service life for copper-bearing metals under atmospheric exposure of uncoated sheets."

This evidence is convincing and unquestioned by every well informed user—evidence that is not biased and cannot be controverted, and which is important to every architect, builder and contractor who uses sheet metal products in any form.

Similar results obtained by other scientific authorities, together with the large number of tests conducted by buyers and users, have demonstrated beyond question or argument that an alloy of copper and steel is the most durable metal that can be used for sheet metal roofing products.

Highest Quality Standards Maintained

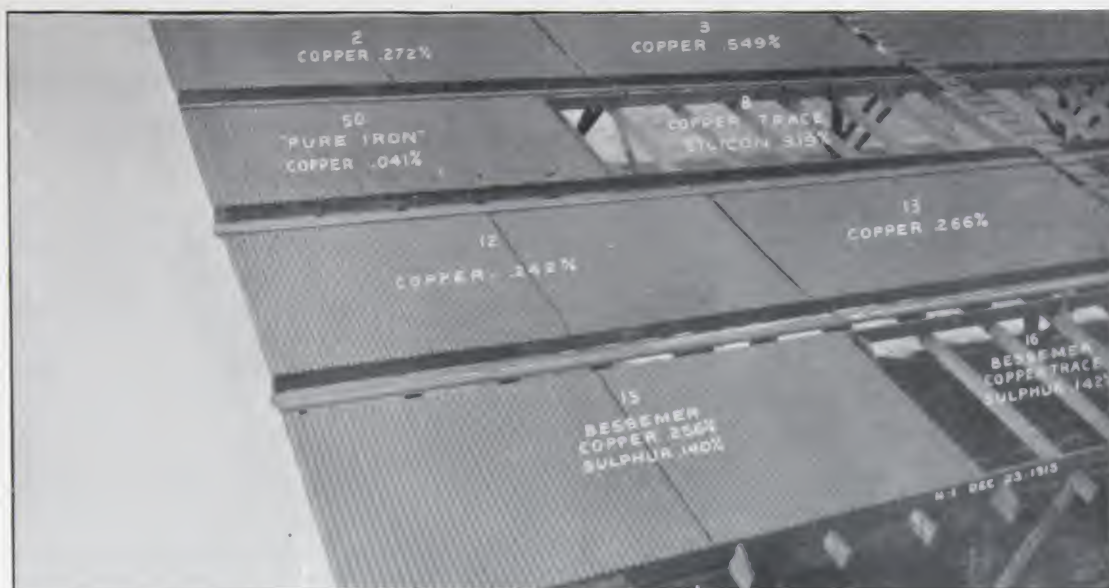
Terne Plate, or "Roofing Tin", is a product made by coating steel or iron sheets with a mixture of lead and tin. Sheets coated in this manner by experienced workmen have been known to last over fifty years and can therefore be said to be the most durable roofing product on the market.

We now make a specialty of Terne Plate for roofing purposes, and are prepared to supply Keystone Copper Steel Roofing Ternes, not only in our own brands, but are prepared to meet the requirements of jobbers whose private brands often necessitate unusual and careful attention in their manufacture.

The assertion from some quarters that "we cannot get good 'roofing tin' any more" is not a fact. **THE SAME GOOD QUALITY PLATES ARE STILL MADE;** but the prevailing tendency to lessen cost by using cheaper grades, and labor, thereby sacrificing the old time quality, has been responsible for unsatisfactory results, and many erroneous statements. It is not to be expected that very light coated ternes will give the service of the old 30 to 40 pound grades. Give the "tin" roof a fair chance, by using good material and workmanship to start with. The results will not be disappointing.

While there have been many forms of roofings exploited in recent years, some of them with extravagant claims of superiority, it has remained for the good old-fashioned "tin" roof to demonstrate its superior worth and advantages by giving good and satisfactory service right on the building.

Much has been said to prejudice the minds of builders and property owners against terne plate as a roofing. Some of this perhaps has been warranted, for it is probably true that inferior material is

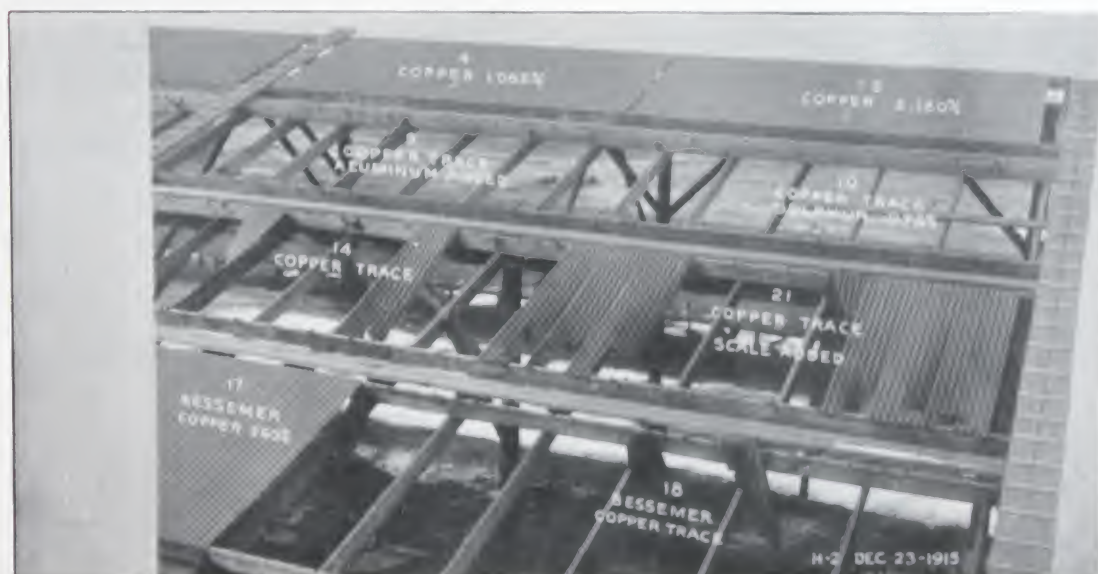


Another Weather Test
Roof at McKeesport,
Pa., showing condition
at close of about 1½
year's exposure.

Roof covered with
uncoated black
sheets

"Pure Iron" panel
No. 50 showing signs of
failure. Copper Steel
alone stood the test
of time and weather.

The amount of
copper required to
give best results
is about .15%.



This Stamp— *on Every Plate*

found on the market which is called "roofing tin." However, only true worth is counterfeited, and the value of a good terne roof is in nowise affected by faulty and worthless substitutes. The real truth is: the terne roof is coming more and more into favor and demand, and it is clearly the roof of the future.

The first mission of a roof is protection—absolute and lasting; all its other features and advantages are secondary. The terne roof meets this first requirement perfectly. We have instances where roofs made of good roofing ternes have lasted for over fifty years, and their service and protection have been faultless.

Advantages of Terne Plate Roofing

The advantages secured by using high quality Terne Plates are many—more in fact than are found in any other roofing material. Terne Roofing embraces so many features of practical worth that it easily commands its place at the head of the list of all modern roofings. We mention but a few of the most important, but there are yet many other qualities of value that will appear to the user only as the years wear over his head:

COST—All things considered, the terne roof is most reasonable in cost. The best of terne plate can be obtained in any quarter at a very moderate price, and when the savings accruing from its use are considered, the item of first cost would be still further reduced.

SERVICE—The terne plate roof gives good service and will last indefinitely. It is impervious to all ravages of the elements, and is practicable in every climate. Those good old Southern homes—palatial monuments of comfort and stability, are roofed with terne plate, and its good service has never been questioned.

MAINTENANCE—The cost for maintenance is the minimum. The old

threadbare complaint—"it has to be painted" is a misleading objection. Of course it has to be painted. So does wood work and finish. The saving in fire insurance alone will often more than cover this very nominal expense—in fact the only attention required by this, the best of roofs.

REPAIRS—The terne plate roof does not require endless repairs, but in case of accident or damage to the roof it can be repaired in any kind of weather and at small expense.

FIREPROOF—This is an important feature. According to a compilation of The Journal of Commerce and Commercial Bulletin, New York, the fire losses for the five years 1925 to 1929, reached the staggering amount of \$1,720,800,810.00. This gives an annual average of property destruction in these five years of \$344,160,162.00. A large proportion of this loss was the result of roof fires. A good terne roof is an effective "blanket policy" in case of fire.

LIGHTNINGPROOF—Protection from this source of frequent loss and damage means much to builders and owners of property in rural districts or communities removed from fire protection. We have no authentic instance of serious damage by lightning to buildings covered with terne roofs.

WEATHERPROOF—Extremes of weather do not affect the terne roof. The sudden deluge, melting snow, or cracking, bulging ice, which is disastrous to many high priced roofings, can do no damage to the terne roof. The continuous, unbroken surface of good terne plate practically seals the top of the building against every condition of weather.

LIGHTNESS—Heavy roofings frequently cause buildings to settle, crack the plaster and ruin interior finish and

All Primes — No Wasters

decorations. With a terne roof, lighter and less expensive structural work may be used, and still have a better roof.

APPEARANCE—The terne plate roof always presents a neat and finished appearance. Particularly is this true of a standing seam roof, and when the ridge is finished with some simple sheet metal design, the roof is very attractive.

SANITARY AND CLEAN—This is important where water from the roof is run into cisterns. The terne roof is eminently clean and sanitary.

APPLICATION—The terne plate roof is easy to apply. The practical tinner is everywhere and his services are always available at a very reasonable figure. This is a decided advantage in case of accidents to the roof, alterations or repairs.

ADAPTABILITY—In its various forms, the terne roof is adapted to all forms and pitches of roofs; and it can be readily applied to irregular surfaces and otherwise difficult roofing propositions.

NOT EASILY DAMAGED—The presence of linemen or firemen upon the roof does not work untold injury and damage, with endless repair bills. The terne roof will withstand a great deal of punishment without serious damage.

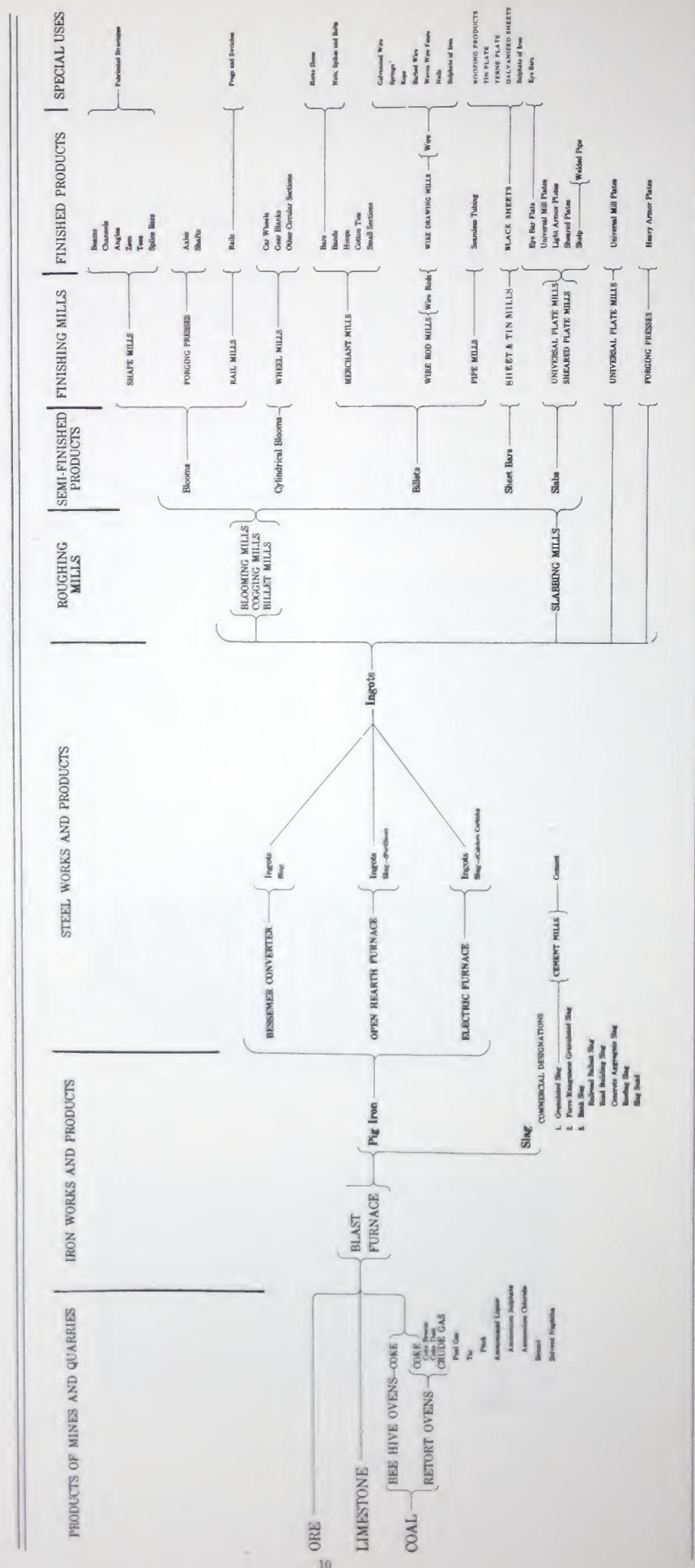
OTHER ADVANTAGES—In addition to the foregoing, when we consider its many other advantages in that it does not crack, warp, split, run, clog gutters, blow off, nor develop any of the annoying traits of many modern roofings, we believe the metal roof is unquestionably the best obtainable.



Five city blocks of Keystone Copper Steel
terne plate roofs, Brooklyn, N. Y.

Diagram of the Manufacture of Steel

as used for Sheet and Tin Mill Products



The diagram shows graphically the various stages in the manufacture of steel. It shows the technical names of the various equipment used in the manufacture of pig iron and steel, and the raw, semi-finished and finished products obtained therefrom in the various works of the United States Steel Corporation.

The Manufacture of Terne Plate or Roofing Tin

The material known as Terne Plate or "Roofing Tin" is composed of three metals—steel or iron, tin, and lead—hence the name "Terne Plate."

The greatest source of iron in this country is in the Lake Superior region, where the ore lies in vast bodies, underneath a relatively thin layer of earth.



1—Ore mine in Lake Superior region.
2—Great Lakes ore steamer.
3—Ore piles at blast furnace.
4—Blast furnace, where ore is reduced to iron.

Practically all the tin used in this country comes from the Far East, where it is mined, smelted, and refined, it being imported in the form of pig tin. Lead is mined, smelted, and refined most largely in our Western States, and reaches the user in the form of pig lead.



1—Open Hearth Furnaces.
2—Running the heat into ladle: Copper is added in ladle.
3—Casting the molten steel into ingots.

The method of mining is usually to remove the earth and then to load the ore by means of steam shovels directly from its bed into railroad cars, these being borne by rails leading onto the piers in the upper lake ports. Large fleets of steamers of large cargo capacity are con-

This Stamp— *on Every Plate*

tinuously in service, during the ice-free season of the lakes, transporting ore to the lower lake ports for immediate consumption and for winter stock. These steamers are loaded and unloaded with remark-



1



2



1—Blooming Mill and roll train; reducing ingot to slabs; or to billets, sheet bars, etc.
2—Sheared Bars. Subsequent rolling is across the short bars, and not lengthwise as might be supposed.

able celerity by means of huge, ingenious mechanical devices.

With coke, made from special coal, mostly mined in the famous Connellsville region, and with limestone as a flux, the ore is smelted in a blast furnace, the metal thus produced being in the form of pig iron.

In this condition, iron is not malleable, and must be especially refined to make it suitable for the basis of Keystone Copper Steel Terne Plate. This is

done in the open hearth furnace, into which is charged the raw material on one side, and from which, on the other, the refined steel is tapped into the ladle. Here the steel receives the copper, thus gaining that property of superior resistance to the corrosive influences of the atmosphere, that characterizes Keystone Copper Steel Terne Plate. After thorough diffusion of the added material, the homogeneous steel is teemed into molds, in which the steel solidifies in ingot form.



1—Hot Rolling. Two sheets are placed together, and doubled and redoubled, and heated and reheated, during the process of reducing the bars to the desired gauge.
2—Reheating Furnace. 3—Shearing. 4—Opening the pack.

The ingot, after having the mold stripped from it, and having been brought to the proper rolling temperature throughout, in a furnace known as

Good Workmanship — Fine Finish

a "soaking pit," is reduced in cross section and increased in length by rolling, in the blooming mill. After having been cut to proper lengths, the billets, as they are then known, are carried by the roll

rolled together. During the process of hot rolling to the desired gauge, the sheets are doubled and redoubled, and heated, and reheated to restore the proper working temperature, the entire sequence of operation being carried on with due regard for every feature that goes to make the excellence of the finished product—Keystone Copper Steel Terne Plate.

The pack of several sheets is sheared with proper allowance for subsequent operations, including resquaring, later, to



1—The Pickler. 2—Annealing Furnace.
3—Cold Rolling the plates.
4—Resquaring. 5—Washing the Plates.

train to the bar mills in which the steel is reduced to the proper thickness, the resulting bars being about eight inches wide. These are cut into lengths corresponding to the width of the sheets to be rolled.

At the rolling mill, the bars are heated in lots in a furnace, whence they are withdrawn in pairs, to be rolled in the hot mill. Each bar is rolled sidewise until its thickness is reduced sufficiently, when they are matched, and afterwards are



1—Hand Dipping the plates into the molten terne mixture.
2—Mechanically cleaning the plates.
3—Inspecting and assorting.

the finished size, and then it is opened, the several sheets being separated.

Steel oxidizes readily at high temperatures, and hot rolling strains the steel.

This Stamp— *on Every Plate*

Hence the sheets after being freed from mill oxide by pickling in a dilute solution of sulphuric acid, are thoroughly washed and carefully annealed under cover.

That the coating may be smooth, the sheets are polished by cold rolling, the surfaces of the rolls being of a very high finish, and then, so that the roofer may lay his roof true, the sheets are accurately resquared.

To remove the slight strains of cold rolling, the sheets are again annealed under cover, and to prepare the sheets finally, for receiving their coating, they

are again pickled, this time much more lightly, and thoroughly washed.

The sheets are coated in a molten bath of tin and lead, the heavier coatings being obtained by redipping by hand, especial care being taken to obtain, by proper distribution of the alloy and its thorough alloying with the base, that reinforced resistance to corrosion that has given Keystone Copper Steel Terne Plate its well-deserved high reputation.

The Terne Plate is then carefully cleaned and inspected, and each perfect sheet impressed with the "stamp of quality"—*Keystone Copper Steel*.



Center Illustration—Stamping the terne plates
"KEYSTONE COPPER STEEL"

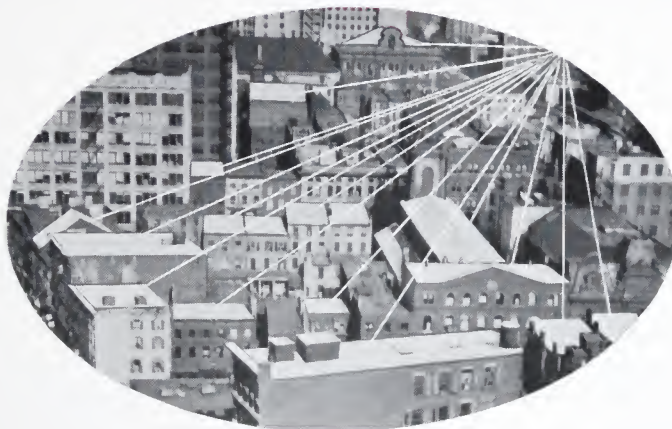
High Quality—Long Service



Home for Aged Women, Boston, Mass.—This MF Roof has given over 40 years' service.



School Building at Jersey City, N. J. Showing MF Roof after 15 years service.



View of a section of New York showing the use of terne plate roofing for fire protection.



This building with flat seam MF Roof, has lasted 25 years.



One of our terne plate roofs which has given 35 years' service.



Residence covered with MF which has given 46 years' splendid service.

This Stamp —  *on Every Plate*

KEYSTONE COPPER STEEL

Roofing Ternes

Highest Quality Terne Plates—with Copper Steel alloy base

Look for the KEYSTONE added to brand and weight of coating
as indicated by MF brand



MF ROOFING TERNES

are made only of the best material, by experienced workmen, and are carefully coated by the hand-dipping, Pure Palm Oil process. MF carries 32 pounds coating, and is the most popular roofing terne plate manufactured. It has been made continuously since 1822. Produced from a Keystone Copper Steel base.

U. S. EAGLE ROOFING TERNES

Positively the highest quality Terne Plate produced in this country. Base of Keystone Copper Steel—coating 40 pounds, applied by a special process—these are roofing plates par excellence.

AMERICAN NUMETHODD ROOFING TERNES

American Numethodd B.....	40-Pounds Coating, Keystone Copper Steel
American Numethodd D.....	30-Pounds Coating, Keystone Copper Steel
American Numethodd F.....	20-Pounds Coating, Keystone Copper Steel

AMERICAN OLD STYLE ROOFING TERNES

American Old Style AAAAAA	40-Pounds Coating, Keystone Copper Steel
American Old Style AAA	30-Pounds Coating, Keystone Copper Steel
American Old Style AA	25-Pounds Coating, Keystone Copper Steel
American Old Style A	20-Pounds Coating, Keystone Copper Steel

AMERICAN ROOFING TERNES

American Special	15-Pounds Coating, Keystone Copper Steel
American	8-Pounds Coating, Keystone Copper Steel

AMERICAN FIRE DOOR STANDARD TERNES

20-Pounds Coating—carefully manufactured to meet the underwriters' requirements. This product will be found satisfactory for all fire door purposes.

AMERICAN LONG TERNES—40-pounds Coating.

A sheet mill product that is proving popular for roofing, particularly valley, eave trough and conductor pipe. It is offered in standard weights and sizes. The sheets are resquared when so ordered, and this is essential for roofing. The finish may be bright, or oil, as specified. Lighter than 10-oz. base gauge may be embossed with private or American brand, including gauge and coating weight. Keystone Copper Steel should always be ordered for Long Terne that is to be subjected to weather exposure.

All Grades — 8 to 40 lbs. Coating

KEYSTONE COPPER STEEL Roofing Ternes

Are also furnished to meet the individual requirements of sheet metal jobbers who have their own private brands. It is to your interest, to insist upon plates of Keystone quality, the right weight of coating (20 to 40 pounds), and good workmanship — and to see that your plates are distinctly stamped "KEYSTONE COPPER STEEL" Thus —



You can buy Roofing Terne Plates with the positive assurance of lasting and satisfactory service — if you demand plates made from KEYSTONE COPPER STEEL. Grades up to 40 pounds coating — *quality* supreme.



Brightwood School Building, Washington, D. C., covered with 100,000 square feet of Keystone Quality Roofing Ternes Plates. — Corner also of Keystone Quality.

Details for Roofing and Sheet Metal Work

The following details adapted from Sweet's Catalogue Service, Inc., are of value and interest to all architects and draftsmen: By using high grade plates and correct workmanship, the architect can demonstrate beyond question that metal makes a better and safer roof, which will afford the maximum of protection from fire, storm, and weather. High quality plates are, and have been, available from the manufacturer. It requires only the specific demand that those responsible supply and use high grade materials.

Terne Plate Roofs can be made both highly satisfactory and attractive when laid by the flat seam, standing seam, ribbed seam, or combination methods. After the initial coats of oxide paint, roofs and exposed sheet metal work may be painted to harmonize with any color scheme desired by the architect—a feature of importance and advantage that is frequently forgotten or overlooked.

Standard Terne Plate Roofing and Sheet Metal Specifications

(1) **MATERIAL—Terne Plate Roofs**—Where terne roofs are required by the drawings, all ternes for roof and surfaces, including flashings, counter-flashings, gutter linings, crickets, etc., shall be [MF, U. S. Eagle, American Old Style, or American Numethod] Brand, Keystone Copper Steel, with [32, 25, 30, 40] lbs. coating. No substitute will be allowed and each plate shall be stamped with name of brand and weight of coating.

(2) All terne plates unless otherwise specified shall be IC thickness.

(3) **SHEET METAL**—All sheet metal for cornices, hanging gutters, downspouts, skylights, ventilators, etc., may be IX heavily coated Ternes or No. 24 gage Apollo-Keystone (Apollo Best Bloom) Galvanized Sheets.

(4) **GUARANTY**—All material and workmanship in connection with roof coverings, including all flashings, counterflashing, ventilators, scuttles, or similar work shall be guaranteed to be the materials specified and the workmanship up to approved standard.

(5) **SHEATHING PAPER**—Roof sections, where terne plates are required, to be covered with rosin-sized building paper weighing at least 6 lbs. per 100 sq. ft. and laid with 2-in. lapped joints.

(6) **FLAT SEAM ROOFING**—Edges of plates shall be turned under $\frac{1}{2}$ in.; all seams shall be well locked and well soaked with solder. Plates to be fastened to sheathing boards by cleats spaced 8 in. apart, cleats locked into seams and fastened to roof with two 1-in. tinned barbed wire nails; no nails to be driven through plates.

(7) **STANDING SEAM ROOFING**—Plates shall be put together in long lengths in the shop, cross seams to be well locked and well soaked with solder; plates to be made up the narrow way in the rolls and fastened to sheathing boards by cleats spaced 1 ft. apart.

(8) **RIBBED ROOFING**—All ribs to be securely nailed to sheathing and of sizes and spacings shown on detail drawings. Plates to be made up the narrow way in rolls and fastened to ribs with cleats 1 ft. apart as detailed.

(9) **CAUTION**—No unnecessary walking over terne roof, or using same for storage of material shall be allowed. In walking on the ternes, care must be taken not to damage paint nor break coating of ternes. Rubber soled shoes or overshoes should be worn by men on the roof.

(10) **FLASHING**—Flash the intersection of all roofs and decks with dormers, chimneys, walls, and all vertical surfaces, about roof cant, about pipes passing through roofs to insure weathertight job, using kind of metal elsewhere specified, with locked and soldered joints.

(11) Base flashing shall be not less than 12 in. high and shall turn out on roofs not less than 4 in., or where roofing is metal shall be connected to same with locked and soldered joints.

(12) All base flashings shall be capped. The cap flashing shall be turned down over the base flashing not less than 4 in. The cap flashing shall be built into the masonry joints not less than 2 in., or into the reglets in stone not less than 1 in., and shall be secured into same with metal plugs leaded in smooth with the stone work. Step flashing shall be used for vertical surfaces in connection with pitched roofs where required. Flashings which are to be built in shall be supplied to the mason when or where he may require.

(13) Base flashing of shafts and skylights must be extended up to curbs and connected to eaves or gutters.

(14) Collars or flashing about plumbing and other pipes extending through roofs shall be turned up at least 8 in. about same. The plumber will call aprons of lead in hub of pipe and turn down over these collars at least 6 in.

(15) **GUTTERS**—Gutters shall be formed at eaves of all roofs as required of the sizes indicated on drawings, laid with continuous fall to drainage points. Wire baskets of same metal as gutters shall be placed over each outlet to leader. Hanging gutters and gutter linings shall be carried up 10 in. under the roofing connected with flashings and roofs with locked and soldered joints.

(16) Hanging gutters shall be made with clamped, riveted and soldered joints with roll on outer rim entirely covering continuous $\frac{3}{8}$ -in. galvanized iron rod which shall be placed therein, supported at least every 4 ft. in length by straps with edges rolled on themselves to stiffen them. They

shall be wrapped around the roll and iron rod on outer edge of gutter and riveted. All rivets, screws, straps, etc., shall be of same.

(17) **LEADERS**—Leaders shall be of ample capacity and same metal as gutters (except where otherwise specified,) and shall be set to all roofs and gutter as shown; hereinbefore specified or necessary.

(18) Interior leaders put in to take the discharge from roof cesspools will be of cast or wrought iron (as provided for under "Plumbing") extended to within 18 in. (or as near as practical) of cesspool outlet and finished with hub end. These shall be connected to gutters and roof cesspools with brass ferrules and 6-lb. lead tubes heavily soldered. Connecting tubes shall have graduated increase of 1 in. in diameter to top.

(19) **DOWN-SPOUTS**—Sheet metal down-spouts shall be as designed. They shall be flanged and soldered to the gutters and secured to the building with tinned conductor hooks or with metal strips $\frac{1}{2}$ by $\frac{1}{2}$ in. in cross section soldered to the down-spouts and fastened to woodwork with screws and to masonry by screws and lead sleeves. Straps and screws shall be galvanized.

(20) Where down-spouts connect with underground drainage system a suitable conductor head shall be provided (by the plumber) at the upper end of the drain pipe to receive the down-spout, and the joint between conductor head and drain pipe made with cement mortar well worked into place and finished smooth by the sheet metal contractor.

(21) **METAL CORNICE**—Furnish and set complete, sheet metal cornice as shown on detail drawings. To be of No. 26 [or No. 24] gage Apollo-Keystone Galvanized Sheets with ornamental work stamped out of heavy zinc.

(22) The cornice shall be built up on heavy galvanized forms bent to correct profiles and firmly anchored in place. All joints, angles, miters and fittings to be thoroughly well made and finished. Ornamental work, modillions, etc., shall be planted on watertight backings.

(23) **SOLDER**—Solder shall be of the best grade, bearing the manufacturer's name and guaranteed one-half tin and one-half lead—new metals. Use rosin only as a flux.

(24) **PAINING**—All sheets shall be clean, so as to obtain close contact of paint and metal. Terne plates should be wiped with benzine, turpentine, or benzol to remove the oil film. Galvanized sheets should be prepared by simple exposure to the weather for a few months until the luster disappears. If necessary to apply paint to new zinc coated sheets, they should first be brushed with a solution of four ounces of copper sulphate, copper chloride, or copper acetate in one gallon of water, and after drying again brushed lightly. Better results may be obtained, if facilities permit, by cleaning with a solution of 200 parts of water, 30 parts trisodium phosphate, and 4 parts of sodium hydroxide, all by weight, at 140 to 180° F., then washing with hot water, followed by etching at room temperature for about one-half minute with solution of 1000 parts water, 200 parts muriatic acid, and 20 parts ammonium nitrate, all by weight, and then washing and thoroughly drying.

(25) The weather should be clear and dry and the paint preferably applied in the afternoon, especially the priming coat, as it is essential that the surface be free from moisture. It is preferable to coat the surfaces in laps with fairly thick priming paint as the sheets are placed in position. The paint may be applied by brush or spray. The priming coat should be thin enough to fill and wet all parts as too thick a paint is liable to bridge over depressions and joints. The finish coat or coats should be thicker, and a total of not less than two coats should be applied, giving time for proper drying between coats.

(26) Paint applied directly to sheet metal should be rust inhibitive, and the priming coat should, therefore, have a basic pigment, such as red lead, lead chromate, or zinc chromate—zinc dust and zinc oxide, three or four to one, make efficient paint for both priming and finishing, especially as primer for zinc coated (galvanized) sheets. Iron oxide paint is used for priming, but much better protection is obtained if it contain 10 per cent or more of basic or chromate pigment, such as zinc oxide, red lead, or zinc chromate. The pigment for the finish may be of any good moisture excluder of suitable color. Linseed oil, preferably boiled, makes a good vehicle for the pigment, and excessive dryer should not be used. The use of boiled linseed oil or durable mixing varnish as part of the last coat adds to gloss and water resistance.

Brief Construction Notes for Roofers

PITCH OF ROOFS—Roofs constructed with a low pitch are made with flat seams, and should preferably be covered with high grade ternes, 20 pounds coating or heavier, from plates 14x20 inches dimension rather than from plates 20x28 inches, because the larger number of seams stiffens the surface and helps to prevent buckles and rattling in stormy weather. For flat seam roof, standard specifications require use of cleats. However, some roofers use 1-inch barbed and tinned roofing nails, driven 6 inches apart, well under the edge. They should be well covered up and the seams should be pounded down over the edge. Nails must never be exposed.

Steep terne plate roofs should be made with standing seams, and from plates 20x28 inches, fastened down with cleats, not over 18 inches apart. The nails should be driven into the cleats only.

For valleys and box gutters, heavily coated IX plate should always be used.

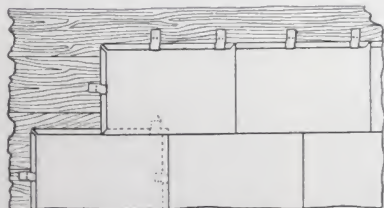
In late years the anxiety of some manufacturers to satisfy the demand of some users for cheap goods has been the cause of many inferior grades being introduced.

This latter class of material may suit for some purposes outside of roofing, or for roofs on temporary buildings; but for roofs that are expected to last, the "higher quality" plates should be used.

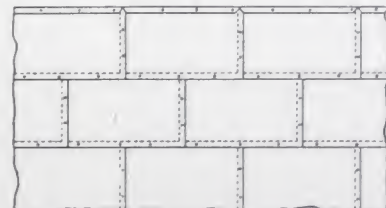
SHEATHING—Sheathing of good, well seasoned dry lumber such as white pine or spruce, narrow widths, free from resinous knots and holes, and of even thickness should be used. Boards should be laid with tight joints.

SHEATHING PAPER—There is a difference of opinion as to whether or not *sheathing paper* is to be recommended; but when the sheathing boards are as specified above, it is hardly necessary. However, if *sheathing paper* is used, it should be waterproof; no tar-paper or papers containing any trace of acid should be used. When no paper is used the terne plate must in all cases be painted on the underside with good reliable oil paint before it is laid and fastened on the roof.

FLAT SEAM ROOF—The roof should have an incline of not less than $\frac{1}{2}$ " per foot over the entire surface. Plates 14" x 20" should be used, as the larger number of seams stiffens the surface and helps prevent buckles. This specification calls for the use of cleats. The work is often done by driving 1-inch barbed and *tinned* roofing nails well under the edges of the seam so as to be entirely covered by the terne plate, as shown below. The nails should be approximately 6- apart. If the terne is carefully laid in this



Method of laying with cleats.



Method of laying with nails driven through plates.

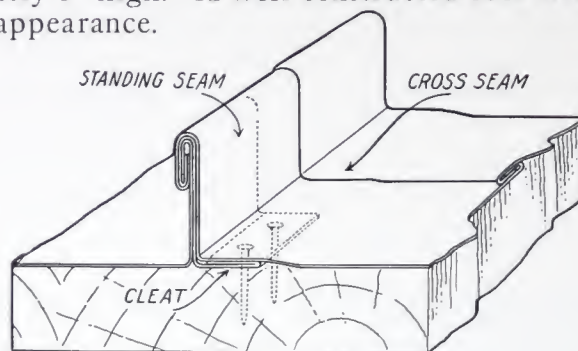
way, it will give good results. However, the use of cleats is preferable. By the use of cleats the roofing terne plates are held firmly in place, and at the same time there is enough elasticity to take care of the small amount of contraction and expansion in ex-

This Stamp — on Every Plate

COPPER STEEL

treme weather, lessening the chances of straining the seams. These cleats are strips of the roofing terne, 1" x 2".

STANDING SEAM ROOF—The roof should have an incline of not less than 2" per foot, preferably 4" to 6" per foot. Plates 20" x 28" are used. Standing seams are finished approximately 1" high. A well constructed roof with standing seams presents a very attractive appearance.



Method of laying Standing Seam

RIBBED AND COMBINATION TERNE PLATE ROOFS—This method of application has very distinctive and attractive possibilities for residences and public buildings. The full details and methods of application have been outlined by a special architectural drawing and are shown on page 23 of this booklet. A careful study of this method of constructing terne roofs is commended to architects and builders.

PLATES REQUIRED TO COVER GIVEN AREA

The following tables will prove of assistance to architects, contractors, and builders in estimating the number of Plates required to cover a given area. The table at right also will give the weights per square of various well known roofing materials.

FLAT SEAM TERNE ROOFING

Table showing number of 14" x 20" sheets required to cover various areas in square feet with flat seam terne roofing. Flat seams, locked 1/2", take 1 1/2" from both width and length, leaving covering area of 231 1/4 sq. in. In the table, a fractional part of a sheet is counted as a full sheet.

No. of sq. ft.	Sheets required	No. of sq. ft.	Sheets required	No. of sq. ft.	Sheets required	No. of sq. ft.	Sheets required
100	63	330	206	560	349	790	492
110	69	340	212	570	355	800	499
120	75	350	218	580	362	810	505
130	81	360	225	590	368	820	511
140	88	370	231	600	374	830	517
150	94	380	237	610	380	840	524
160	100	390	243	620	387	850	530
170	106	400	250	630	393	860	536
180	113	410	256	640	399	870	542
190	119	420	262	650	405	880	548
200	125	430	268	660	411	890	555
210	131	440	274	670	418	900	561
220	137	450	281	680	424	910	567
230	144	460	287	690	430	920	573
240	150	470	293	700	436	930	580
250	156	480	299	710	443	940	586
260	162	490	306	720	449	950	592
270	169	500	312	730	455	960	598
280	175	510	318	740	461	970	605
290	181	520	324	750	468	980	611
300	187	530	331	760	474	990	617
310	194	540	337	770	480		
320	200	550	343	780	486		

1,000 square feet, 623 sheets.

A package of 112 sheets, 14" x 20", covers approximately 180 square feet.

STANDING SEAM TERNE ROOFING

Table showing number of 20" x 28" sheets required to cover various areas in square feet with standing seam terne roofing. Standing side seams, 3/4" to 1" high, locked 3/4" to 1/2", take 2 1/2" from width, and flat end seams take 1 1/2" from length, leaving covering area of 457 1/4 sq. in. In the table a fractional part of a sheet is counted as a full sheet.

No. of sq. ft.	Sheets required	No. of sq. ft.	Sheets required	No. of sq. ft.	Sheets required	No. of sq. ft.	Sheets required
100	32	330	104	560	177	780	246
110	35	340	108	570	180	790	249
120	38	350	111	580	183	800	253
130	41	360	114	590	186	810	256
140	45	370	117	600	190	820	259
150	48	380	120	610	193	830	262
160	51	390	123	620	196	840	265
170	54	400	127	630	199	850	268
180	57	410	130	640	202	860	271
190	60	420	133	650	205	870	275
200	64	430	136	660	208	880	278
210	67	440	139	670	212	890	281
220	70	450	142	680	215	900	284
230	73	460	145	690	218	910	287
240	76	470	149	700	221	920	290
250	79	480	152	710	224	930	294
260	82	490	155	720	227	940	297
270	86	500	158	730	231	950	300
280	89	510	161	740	234	960	303
290	92	520	164	750	237	970	306
300	95	530	168	760	240	980	309
310	98	540	171	770	243	990	312
320	101	550	174				

1,000 square feet, 316 sheets.

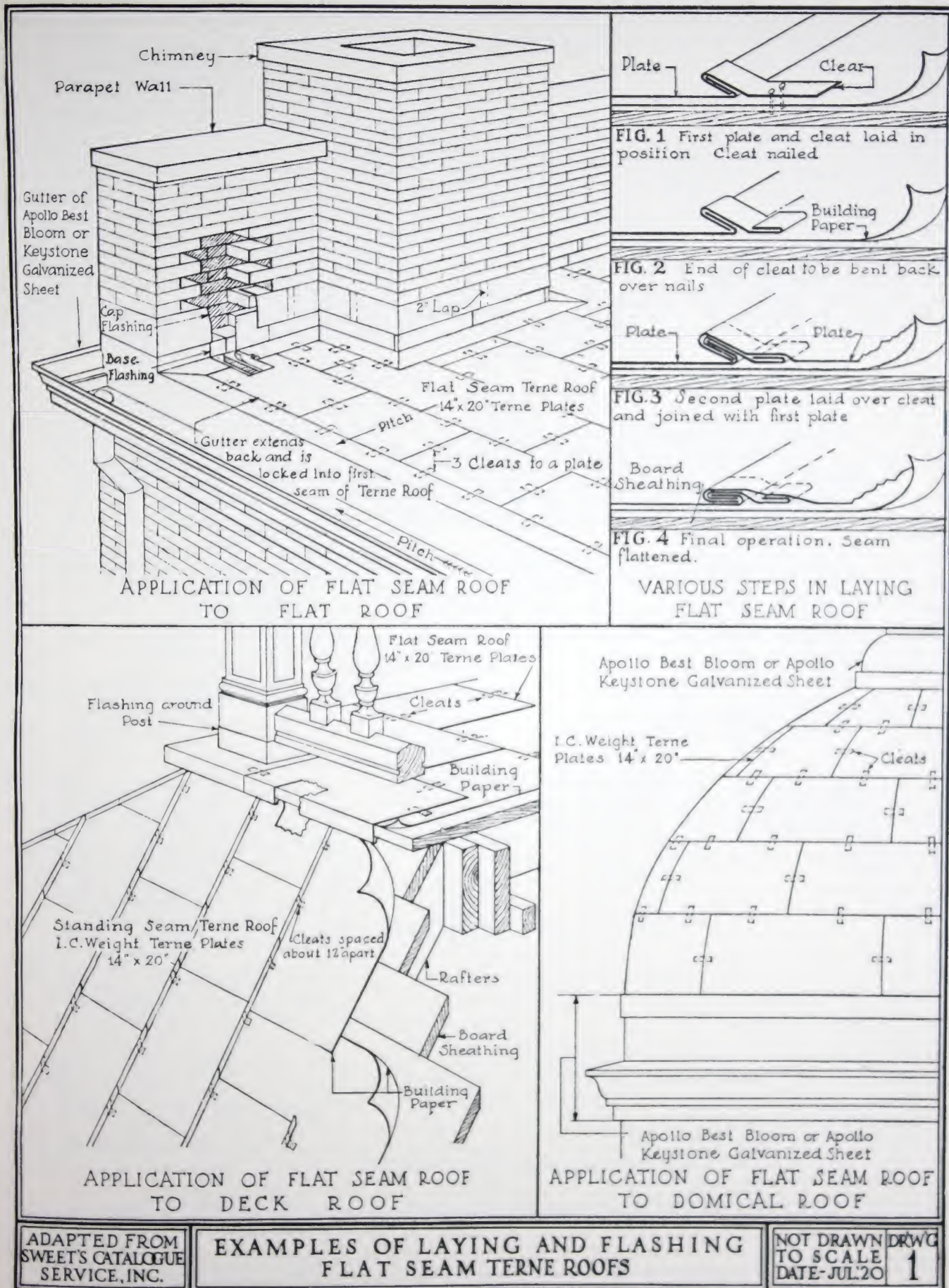
A package of 112 sheets, 20" x 28", covers approximately 356 square feet.

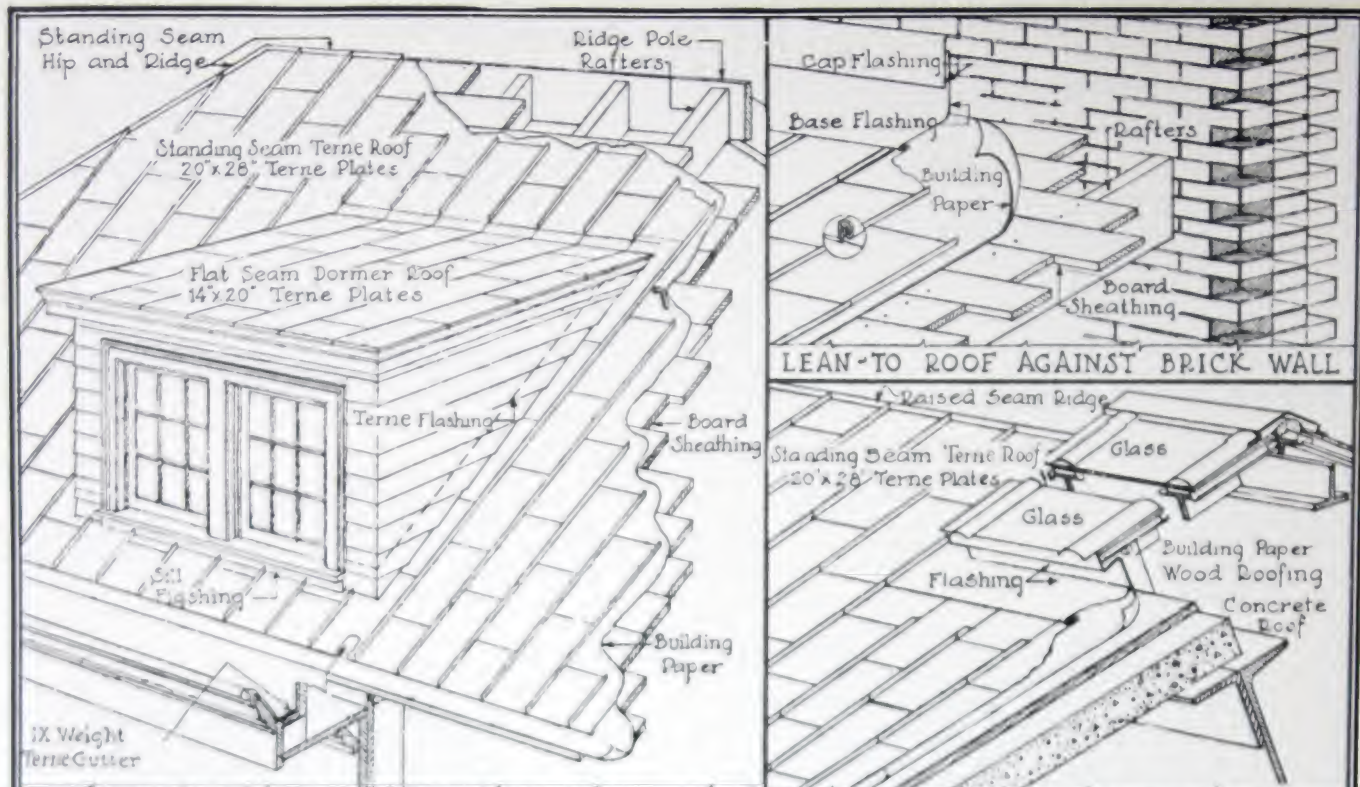
WEIGHTS OF ROOFING MATERIALS

Table showing approximate weights per square foot of various materials used for roofing.

MATERIAL	Av. Wt. —lb. per sq. ft.
Corrugated Galvanized Sheet Steel	
No. 18 G. S. G.	2 3/4
No. 20 G. S. G.	2 1/4
No. 22 G. S. G.	1 3/4
Copper, No. 22 B. & S. G.	1 1/4
Felt, 2 layers	1/2
Felt and Asphalt or Coal Tar	2
Glass, 1/2 inch thick	1 1/4
Hemlock sheathing, 1 inch thick	2 1/2
Lath and plaster ceiling (ordinary)	6 to 8
Lead, 1/2 inch thick	7 1/2
Shingles, 6x18—1/3 to weather	2
Skylight of glass, 1/4 to 1/2 inch, including frame	4 to 10
Slag roof, 4-ply, with cement and sand	4
Slate, 1/2 inch thick, 3 inch double lap	4 1/2
Slate, 3/4 inch thick, 3 inch double lap	6 1/2
Spruce sheathing, 1 inch thick	2 1/4
Terne plate, 1C	5 1/2
Terne plate, 1X	5 1/4
Tiles (plain) 10 1/2 x 6 1/4 x 5/8—5 1/4 inches to weather	18
Tiles (Spanish) 14 1/2 x 10 1/2 x 7/8 inches to weather	8 1/4
White pine sheathing, 1 inch thick	2 1/4
Yellow pine sheathing, 1 inch thick	3 1/4
Zinc, No. 20 B. & S. G.	1 1/4

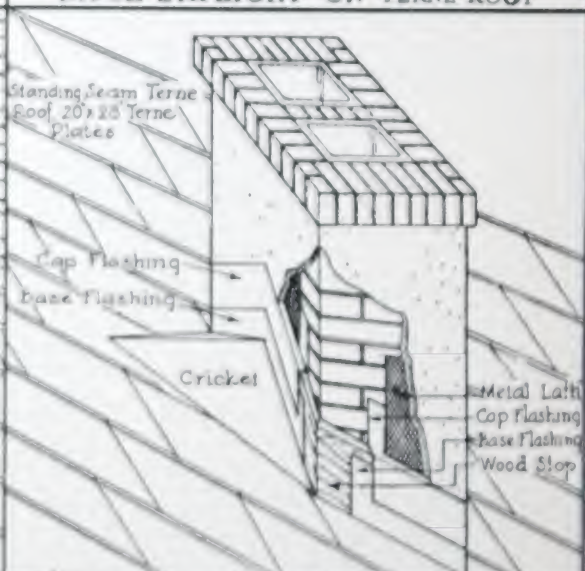
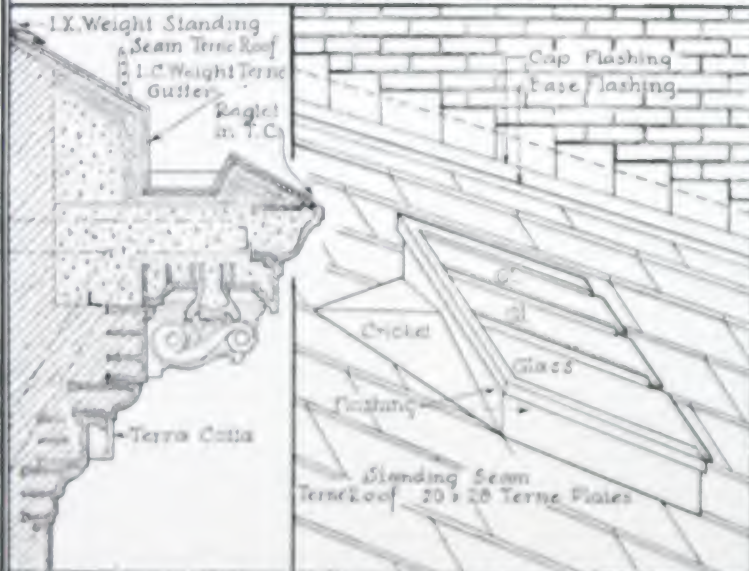
Note the advantage of using sheet metal to reduce weights on roofs.





DORMER WINDOW ON TERNE ROOF

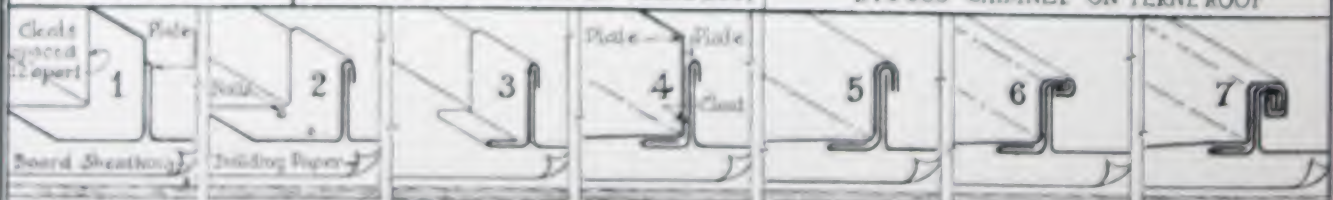
RIDGE SKYLIGHT ON TERNE ROOF



TERRA COTTA CORNICE

FLAT WOOD SKYLIGHT ON TERNE ROOF

STUCCO CHIMNEY ON TERNE ROOF



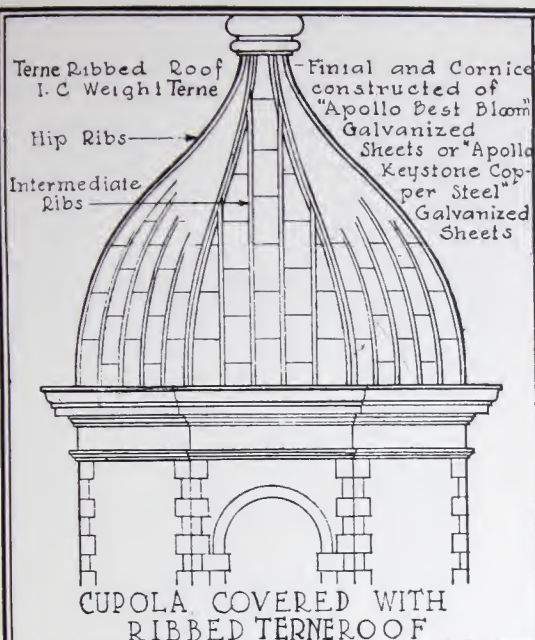
Lay cleat and plate with edges turned up (Fig 1). Nail cleats to sheathing 6 in apart (Fig 2). Turn cleat over nails (Fig 3). Lay adjoining plate (Fig 4). Turn top edge of plate starting lock (Fig 5). Turn lock again (Fig 6). Completed lock seam (Fig 7). Lay adjoining plate.

VARIOUS STEPS IN LAYING STANDING SEAM ROOF

ADAPTED FROM
SWEET'S CATALOGUE
SERVICE, INC.

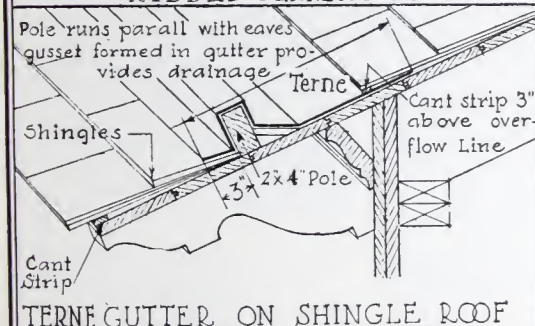
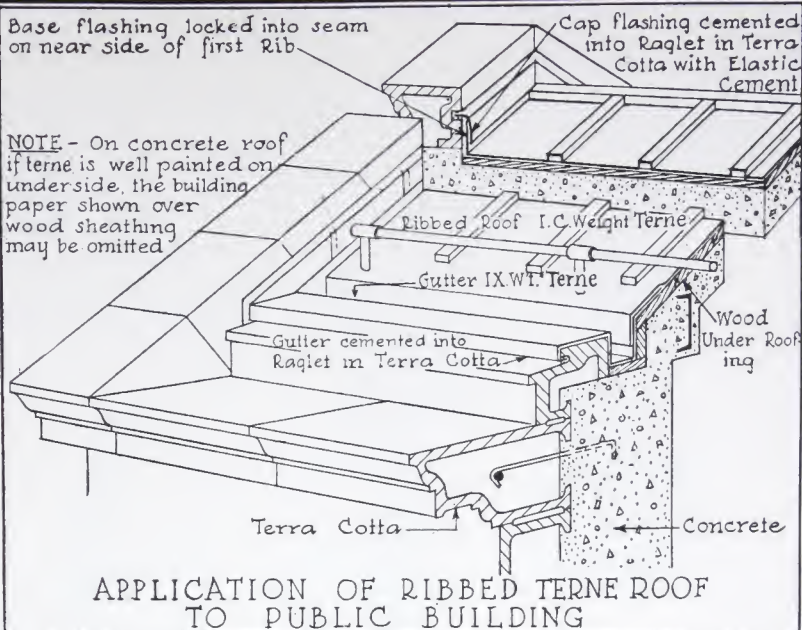
EXAMPLES OF LAYING AND FLASHING STANDING SEAM TERNE ROOFS

SCALE 1 1/2" = 3' DRWG
EQUALS 1" = 0'
DATE - JUL 20 2



Base flashing locked into seam on near side of first rib

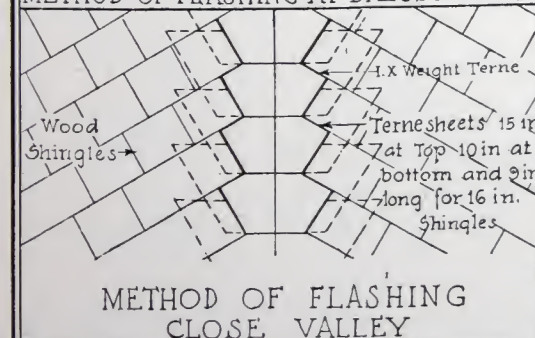
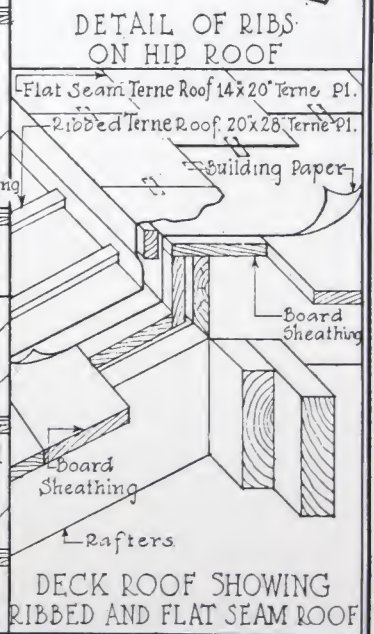
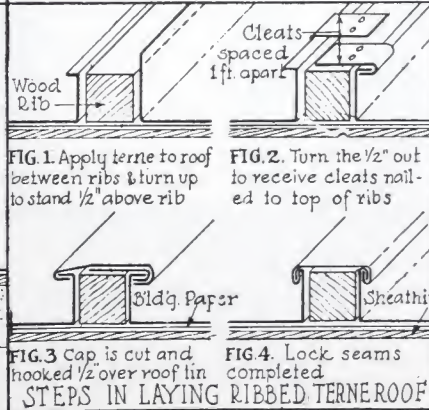
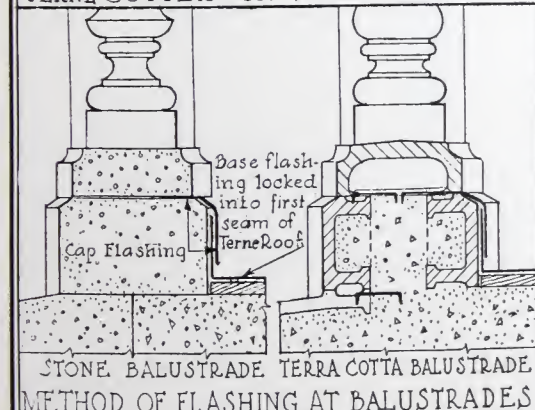
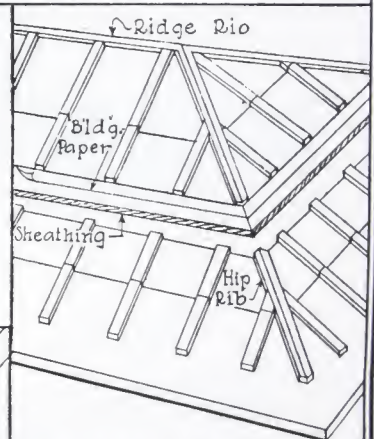
NOTE - On concrete roof if terne is well painted on underside, the building paper shown over wood sheathing may be omitted



The quality of the material used for Roofing Ternes is important



Look for this stamp—the Copper Steel alloy gives maximum wear and superior resistance to rust

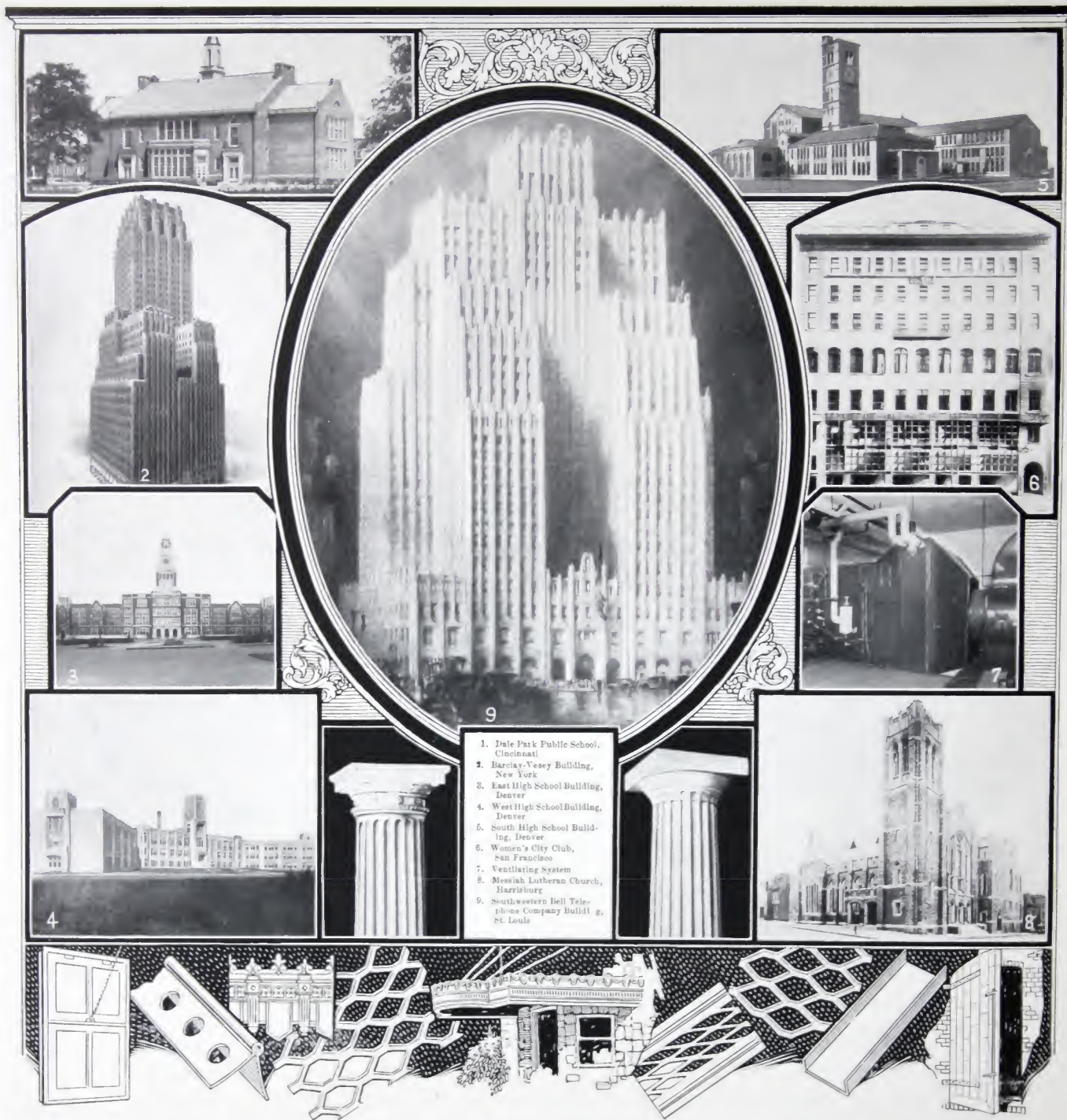


ADAPTED FROM
SWEET'S CATALOGUE
SERVICE, INC.

EXAMPLES OF LAYING AND FLASHING
RIBBED AND COMBINATION TERNE ROOFS

SCALE 1 1/2" = 1'-0"
DATE JUL. 20

DRWG
3

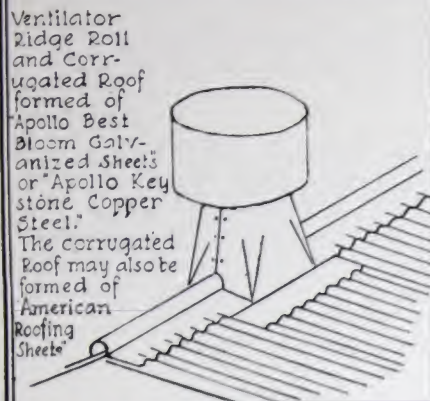


Apollo and Apollo-Keystone Galvanized Sheets

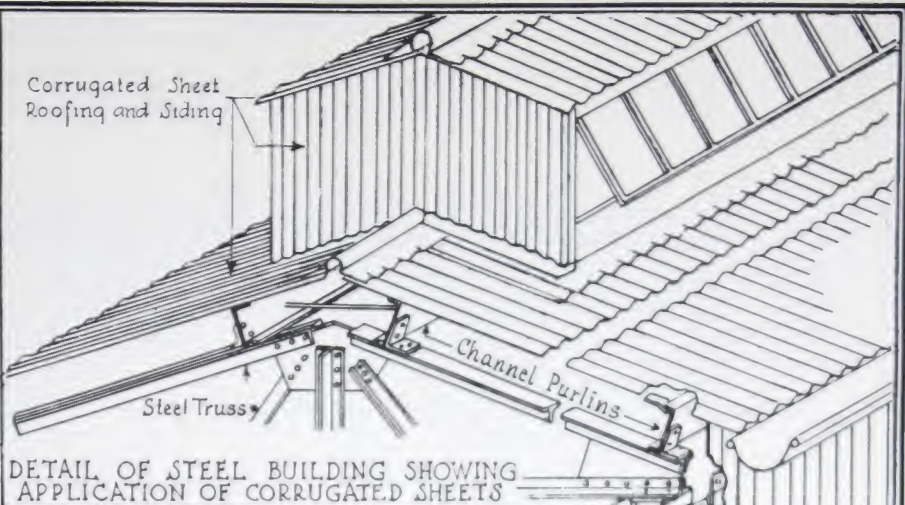
In addition to the terne roof, the galvanized sheet metal work is an important feature of any building. Use APOLLO Best Bloom Galvanized—leading brand since 1884. APOLLO-KEYSTONE Galvanized (with alloy of copper) gives *maximum rust-resistance*, and is unexcelled for roofing, siding, gutters, spouting, eaves trough, ventilators, and similar uses requiring lasting service and quality. Our Apollo booklet will interest users of galvanized sheets.



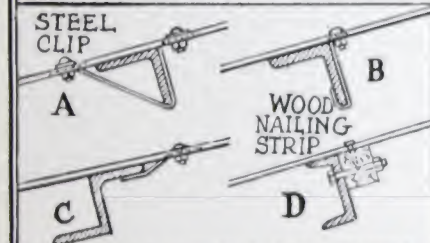
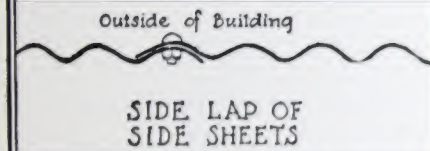
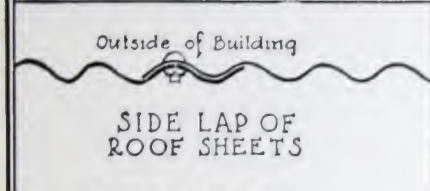
Corrugated Galvanized Sheets are extensively used in industrial construction. The details shown on opposite page will prove of value in designing work of this character.



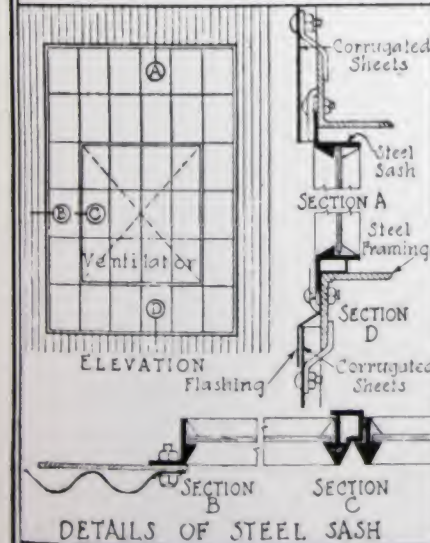
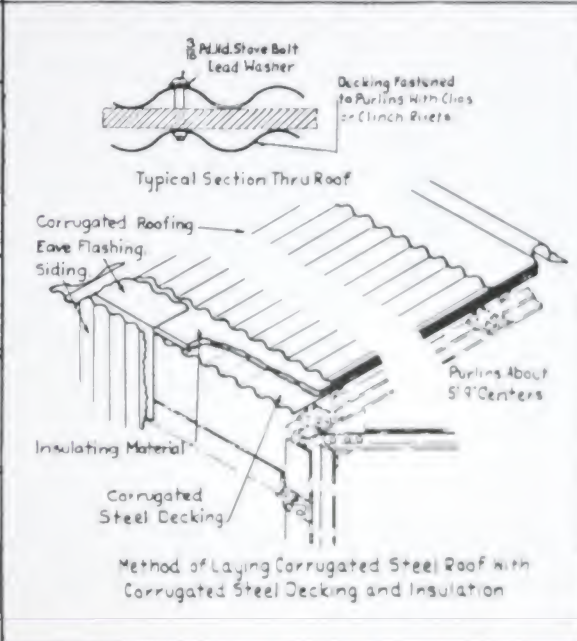
VENTILATOR TYPE GENERALIZED



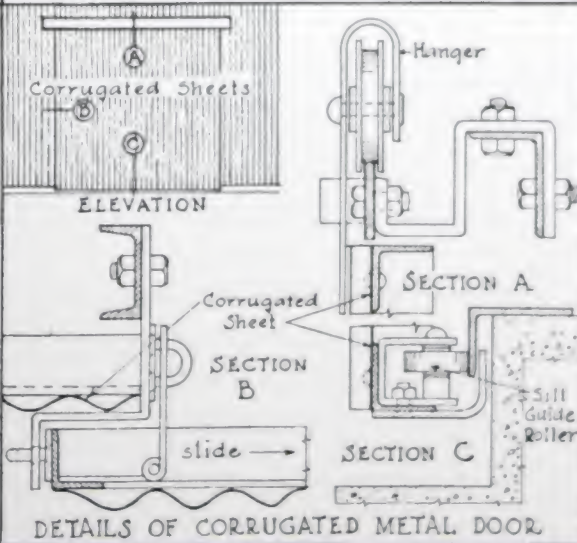
DETAIL OF STEEL BUILDING SHOWING APPLICATION OF CORRUGATED SHEETS



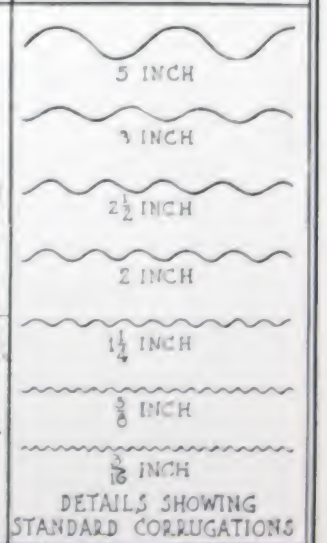
METHODS OF APPLYING CORRUGATED ROOFING TO STEEL PURLINS



DETAILS OF STEEL SASH



DETAILS OF CORRUGATED METAL DOOR



ADAPTED FROM
SWEET'S CATALOGUE
SERVICE, INC.

METHOD OF APPLYING APOLLO KEYSTONE COPPER STEEL
& APOLLO BEST BLOOM CORRUGATED GALVANIZED SHEETS

SCALE 3" DRWG
EQUALS 1'-0"
DATE-JUL'20 4

Keystone Quality — Proved by Time and Weather

Facts to Remember

Keystone Copper Steel is an *alloy* made by *adding* a certain amount of copper to well made steel, thereby greatly increasing its enduring quality and rust resistance.



Look for the Keystone back of the regular brand, as indicated by Apollo Galvanized Sheets shown above. Send for new Weight Cards giving sizes, gauges, etc.

Copper added to steel is *not* an impurity any more than copper is an impurity in brass or bronze. It loses its identity as a metal by becoming thoroughly diffused with the steel—thus forming a *new metal or alloy*.

Copper in steel *does not increase* corrosion. On the contrary *it retards* corrosion. The tests and illustrations speak for themselves. If you do not believe them, make a test of your own.

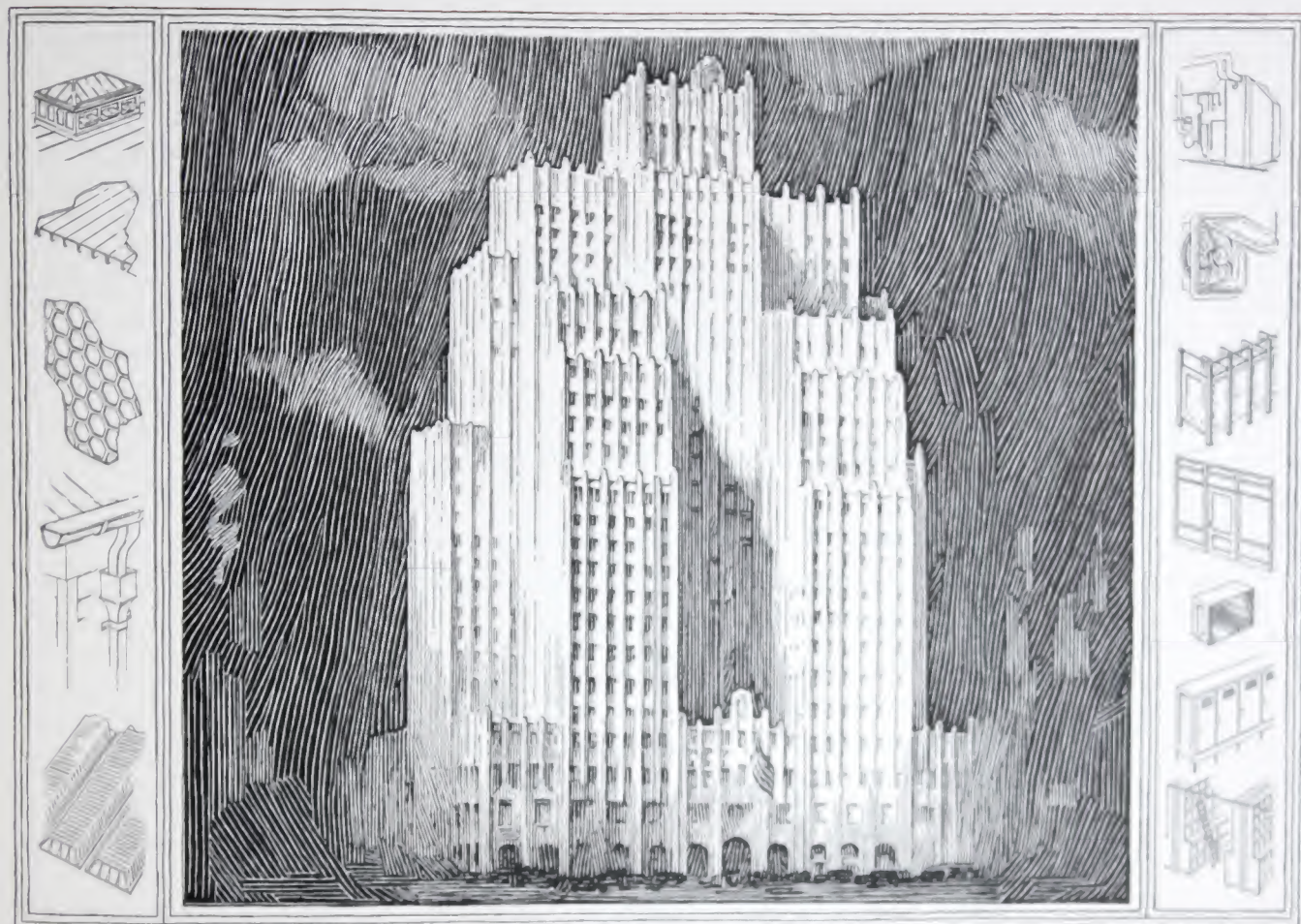
Copper in steel increases its *ductility*—makes it more workable. This copper steel alloy is specially adapted for roofing and sheet metal work in building construction.

The growing demand for Keystone Copper Steel is the best evidence of its excellence. Its high reputation has been fairly earned—and has come as a result of its undeniable superiority in the hands of the users.

Keystone Copper Steel products were awarded the GRAND PRIZE (highest award) for *general excellence* and *greatest merit* and *highest development*, by the Panama-Pacific International Exposition, San Francisco. This high recognition followed very careful and thorough investigations by able juries, and is convincing evidence of the high quality of this material.



Carefully Manufactured — Unequaled in Service



Southwestern Bell Telephone Company Building, St. Louis, Mo.—Apollo-Keystone Copper Steel Galvanized Sheets used for heating and ventilating sheet metal work.

SHEET METAL—For Buildings Like This

For concrete forms, metal lath, doors, partitions, trim, sash, ventilating systems, furniture, lockers — in fact, from heating plant to skylight, AMERICAN Sheets and Terne Plates are specially adapted for high class permanent structures, as well as for the general building field.

Choose AMERICAN Products for your building requirements. This Company manufactures a complete line of Black and Galvanized Sheets, Formed Roofing and Siding Products, Sheets for Metal Furniture and other special purposes, Stainless and Heat Resisting Steel Sheets, Terne Plates and Tin Plates—adaptable for all uses to which sheet metal is suited. When maximum rust-resistance is a factor, specify for KEYSTONE Copper Steel—the *original* rust-resisting copper steel alloy.

American Sheet and Tin Plate Company

SUBSIDIARY OF UNITED STATES STEEL CORPORATION



Manufacturers of Sheet and Tin Mill Products
for all purposes

Apollo Best Bloom Galvanized Sheets
Apollo-Keystone Copper Steel Galvanized Sheets
Black Sheets of Every Description
Keystone Copper Steel Black Sheets
Keystone-Wellsville Polished Steel Sheets
Corrugated Sheets—Black, Painted, Galvanized
Formed Roofing and Siding Products
Full Finished Sheets
Automobile Sheets—All Grades
Sheets for Electrical Apparatus
Special Sheets for Stamping
Keystone Copper Steel Terne Plates
Long Terne Sheets
Bright Tin Plates and Black Plate
Sheets for Special Purposes
Stainless and Heat Resisting Steel Sheets

Eighth Edition



1931



